



High-Temperature Superconducting Degaussing for Ships

ONR Program Code 33

April 2009

At a Glance

What is it?

■ The High Temperature Superconducting (HTS) degaussing coil system neutralizes a ship's inherent magnetic field, interfering with undersea mines' ability to detect and detonate when a large magnetic field – like the one created by a ship – comes within close proximity.

How does it work?

■ HTS degaussing neutralizes a ship's magnetic field by sending electrical currents through ceramic cables encircling all or part of a ship. HTS degaussing replaces legacy copper coils providing the same function, but much more efficiently due to the use of superconducting materials.

What will it accomplish?

■ HTS provides superior degaussing over legacy copper coils, is more efficient producing a great "coil effect" with less energy, and weighs significantly less than copper systems. Weight and space savings provide options to naval architects for added mission payload, additional fuel, or future systems to be added to the ship over its life cycle.

Point of Contact

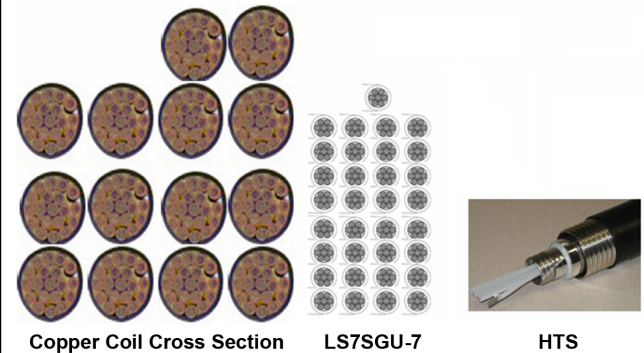
George Stimak
george.stimak@navy.mil
703-588-0616

www.onr.navy.mil

Naval mine strikes are the root cause of 77 percent of U.S. Navy ship casualties occurring since 1950. Most recently, the modern warships USS Samuel B. Roberts, USS

Princeton (CG-59) and USS Tripoli (LPH-10) were severely damaged by mine warfare during Persian Gulf conflicts.

Comparison of Copper Degaussing Coil Size to HTS



With increased operations in the coastal areas (or littorals) of the world's oceans, U.S. Navy ships face an increasing threat from naval mines. As the mine threat has become more sophisticated, degaussing systems have evolved in complexity. Copper coil based systems have impacted ship designs in terms of weight and size requirements. Utilization of High Temperature Superconducting (HTS) technology can alleviate to a large extent the weight and space impact to the ship of legacy degaussing system designs.

ONR embarked on a multi-year FY05-FY07 Discovery and Invention Research (D&I) plan after a D&I feasibility study ending in FY04 indicated payoff for the technology. In partnership with the Naval Surface Warfare Center Carderock Division's Ship Engineering Station Philadelphia, an HTS degaussing coil system was installed on board the USS Higgins (DDG 76) in July 2008. The new HTS degaussing coil—the first of its kind to be installed on board a naval vessel—successfully produced a full "coil effect" and delivered the first-ever measurement of a degaussing system using superconductive materials on April 1st 2009 as the ship completed a pass over the U.S. Navy Magnetic Silencing Range in San Diego California.

Research Challenges and Opportunities:

- Advancement of acoustic Stirling cryocooler or other maintenance free cooling cycle to improve heat lift in range
- Superconductive to non-superconductive materials connections
- Techniques for field repair of HTS cables including vacuum repair of breached cryostat.